

nasal bones almost recall those of the negro; the nasal index being as high, respectively, as 542 and 563. These are both feminine-looking heads, and one of them is the most and the other the least deformed of the set. Whether this form of nose is met with in any other undoubtedly aboriginal American crania, is subject for investigation. Apart from these, the skulls are remarkably like the majority of those which I have seen of Peruvians, Mexicans, and the ancient mound-builders of the United States.

Of lower jaws there are in all twenty-two, a number which indicates that many of the crania must now be missing from the collection. They are interesting as showing age, and peculiarities of dentition; nineteen are adults, and three young. The youngest has the milk teeth only—the first permanent molar, and first incisors being just about to appear (about six years old). One is a little older, the first molar being fully in place with the two milk molars. Another has all the permanent teeth in place, except the last molars (wisdom teeth), which are still in their alveoli.

In all the others the permanent teeth appear to have been fully in place, but the number of losses sustained during life is remarkable. As so many of the teeth have dropped out since death, it is mainly by the condition of the alveoli that their presence or absence during life can be judged of, for in only two or three do all appear to have been retained. Two are absolutely edentulous. In eight, not one of the true molars remain, the whole available dentition being represented by the incisors, and in a few cases by an isolated canine or premolar. Seven had lost one or more of the true molars. All the teeth, except those of the very young individuals, are much worn, but scarcely any show signs of disease or decay, there being only three small carious cavities among them all. Yet the milk molars in both the child's jaws, which were soon to be shed, have their crowns deeply excavated.

The only dental anomaly is that in one of the skulls the right upper wisdom tooth is placed horizontally, its crown projecting outwards through the surface of the maxillary bone, its lower edge two millimetres above the alveolar border.

The limb bones indicate an average height rather below the middle size, but, as just stated, I have not yet had time to make accurate measurements and calculations.

Clavicles, 7 right, 10 left, all adult. *Scapulae*, all more or less broken; fragments of 15 right and 11 left adult, and 1 young. *Humeri*, right, 5 adult and 2 young; left, 10 adult, 1 young (not corresponding with either of those of the opposite side). *Radii*, right, 14 adult, 3 young; left, 17 adult, 1 young. *Ulnae*, right, 14 adult, 2 young; left, 10 adult, 1 young. *Pelvic bones*, mostly very fragmentary, but showing evidence of at least 9 adult males, 5 adult females, and several children. *Femora*, as with the other long bones, there are very few pairs, thus showing that there were more individuals than the actual number of bones would indicate: right, 11 adult and 2 young, 1 nearly full grown, but without epiphyses, 1 younger; left, 17 adult and 6 young of various ages, from quite small children upwards. None of these six have corresponding bones of the opposite side, so there is evidence from the femora of at least 23 individuals. *Tibiae*, 18 right and 19 left, all adult. *Fibulae*, 12 right and 11 left adult, and 3 young.

One of the largest of the femora has the head greatly enlarged and deformed by chronic rheumatic arthritis. The lower articular surface was mostly broken away, but the portion that remained appeared healthy.

One of the left tibiae shows throughout the shaft marked evidence of chronic periostitis, the surface being thickened and vascular. A bone of the opposite side, which might have been of the same individual, shows the same condition in a less marked degree.

These are the only pathological conditions observed in any of the bones.

The question that naturally occurs after the examination of these remains is, How did they get into the cave? The condition of the bones, and of the objects which were found with them all, point to their belonging to the native Indian inhabitants, and not to any of the races which have been introduced into the island during the last four hundred years. A cave of such small dimensions, in which a man could not stand upright, could scarcely have been the regular habitation of such a large number of persons. It might have been a place of sepulture, but from its inaccessible position it seems more likely to have been a refuge to which the young, the feeble and the aged of a tribe had fled for safety,

and in a vain endeavour to escape the horrible massacres by which we know the great bulk of the native population perished, had met a scarcely less miserable fate. Other similar discoveries, which will doubtless be made in the future, may throw light upon this question, and it is satisfactory to know that the authorities of the Jamaica Institute are now alive to the importance of carefully examining and preserving all such evidence as may still remain of the ancient history of the island and its inhabitants. The communication was illustrated by sketches of the cave, made by Mrs. Frank Cundall.

ELECTRIFICATION AND DISELECTRIFICATION OF AIR AND OTHER GASES.¹

§ 1. EXPERIMENTS were made for the purpose of finding an approximation to the amount of electrification communicated to air by one or more electrified needle points. The apparatus consisted of a metallic can 48 cms. high and 21 cms. in diameter, supported by paraffin blocks, and connected to one pair of quadrants of a quadrant electrometer. It had a hole at the top to admit the electrifying wire, which was 5.31 metres long, hanging vertically within a metallic guard tube. This guard tube was always metallically connected to the other pair of quadrants of the electrometer and to its case, and to a metallic screen surrounding it. This prevented any external influences from sensibly affecting the electrometer, such as the working of the electric machine which stood on a shelf 5 metres above it.

§ 2. The experiment is conducted as follows:—One terminal of an electric machine is connected with the guard tube, and the

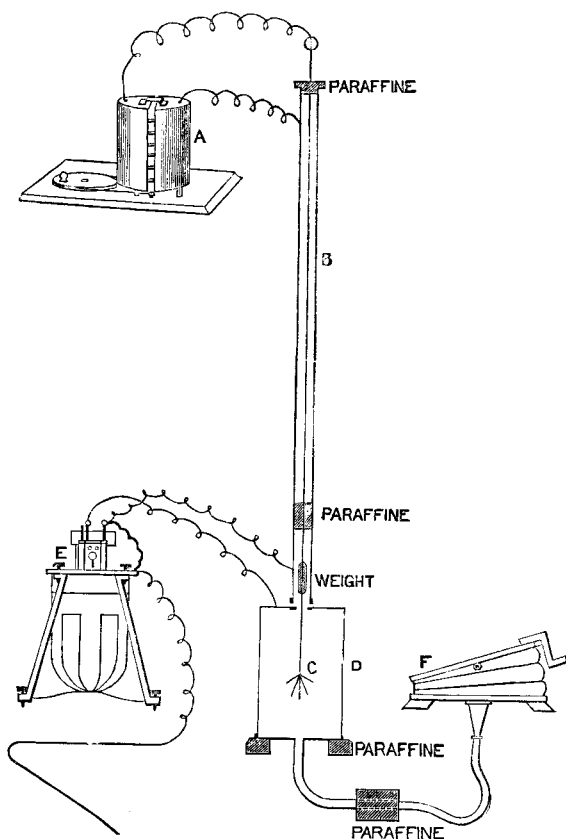


FIG. 1.—Connected with guard screen (not shown in diagram).

other with the electrifying wire, which is let down so that needle is in the centre of the can. The can is temporarily connected to the case of the electrometer. The electric machine is then worked for some minutes, so as to electrify the air in the can. As soon as the machine is stopped the electrify-

¹ Abstract of a paper, by Lord Kelvin, Magnus Maclean, and Alexander Galt, read before Section A of the British Association.

ing wire is lifted clear out of the can. The can and the quadrants in metallic connection with it are disconnected from the case of the electrometer, and the electrified air is very rapidly drawn away from the can by a blowpipe bellows arranged to suck. This releases the opposite kind of electricity from the inside of the can, and allows it to place itself in equilibrium on the outside of the can and on the insulated quadrants of the electrometer in metallic connection with it.

§ 3. We tried different lengths of time of electrification and different numbers of needles and tinsel, but we found that one needle and four minutes of electrification gave nearly maximum effect. The greatest deflection observed was 936 scale divisions. To find, from this reading, the electric density of the air in the can, we took a metallic disc, of 2 cms. radius, attached to a long varnished glass rod, and placed it at a distance of 1.45 cm. from another and larger metallic disc. This small air condenser was charged from the electric light conductors in the laboratory to a difference of potential amounting to 100 volts. The insulated disc thus charged was removed and laid upon the roof of the large insulated can. This addition to the metal in connection with it does not sensibly influence its electrostatic capacity. The deflection observed was 122 scale divisions. The

capacity of the condenser is approximately $\frac{\pi \times 2^2}{4\pi \times 1.45} = \frac{1}{1.45}$. The quantity of electricity with which it was charged was $\frac{1}{1.45} \times \frac{100}{300} = \frac{1}{4.35}$ electrostatic unit. Hence the quantity to give 936 scale divisions was $\frac{1}{4.35} \times \frac{936}{122} = 1.7637$.

The bellows was worked vigorously for two and a half minutes, and in that time all the electrified air would be exhausted. The capacity of the can was 16,632 cubic centimetres, which gives, for the quantity of electricity per cubic centimetre, $1.7637 = 1.06 \times 10^{-4}$. The electrification of the air in this case was positive; it was about as great as the greatest we got,

whether positive or negative, in common air when we electrified it by discharge from needle points. This is about four times the electric density which we roughly estimated as about the greatest given to the air in the inside of a large metal vat, electrified by a needle point and then left to itself, and tested by the potential of a water-dropper with its nozzle in the centre of the vat, in experiments made two years ago and described in a communication to the Royal Society in May, 1894.¹

§ 4. In subsequent experiments, electrifying common air in a large gas-holder over water by an insulated gas flame burning within it with a wire in the interior of the flame kept electrified by an electric machine to about 6000 volts, whether positively or negatively, we found as much as 1.5×10^{-4} for the electric density of the air. Electrifying carbonic acid in the same gas-holder, *whether positively or negatively*, by needle points, we obtained an electric density of 2.2×10^{-4} .

§ 5. We found about the same electric density (2.2×10^{-4}) of *negative* electricity in carbonic acid gas drawn from an iron cylinder lying horizontally, and allowed to pass by a U-tube into the gas-holder without bubbling through the water. This electrification was due probably not to carbonic acid gas rushing through the stopcock of the cylinder, but to bubbling from the liquid carbonic acid in its interior, or to the formation of carbonic acid snow in the passages and its subsequent evaporation. When carbonic acid gas was drawn slowly from the liquid carbonic acid in the iron cylinder placed upright, and allowed to pass, without bubbling, through the U-tube into the gas-holder over water, no electrification was found in the gas unless electricity was communicated to it from needle points.

§ 6. The electrifications of air and carbonic acid described in §§ 4 and 5 were tested, and their electric densities measured by drawing by an air pump a measured quantity of the gas² from the gas-holder through an india-rubber tube to a

receiver of known efficiency and of known capacity in connection with the electrometer. We have not yet measured how much electricity was lost in the passage through the india-rubber tube. It was not probably nothing; and the electric density of the gas before leaving the gas-holder was no doubt greater, though perhaps not much greater, than what it had when it reached the electric receiver.

§ 7. The efficiency of the electric receivers used was approximately determined by putting two of them in series, with a paraffin tunnel between them, and measuring by means of two quadrant electrometers the quantity of electricity which each took from a measured quantity of air drawn through them. By performing this experiment several times, with the order of the two receivers alternately reversed, we had data for calculating the proportion of the electricity taken by each receiver from the air entering it, on the assumption that the proportion taken by each receiver was the same in each case. This assumption was approximately justified by the results.

§ 8. Thus we found for the efficiencies of two different receivers respectively 0.77 and 0.31 with air electrified positively or negatively by needle points; and 0.82 and 0.42 with carbonic acid gas electrified negatively by being drawn from an iron cylinder placed on its side. Each of these receivers consisted of block tin pipe, 4 cms. long and 1 cm. diameter, with five plugs of cotton wool kept in position by six discs of fine wire gauze. The great difference in their efficiency was no doubt due to the quantities of cotton wool being different, or differently compressed in the two.

§ 9. We have commenced, and we hope to continue, an investigation of the efficiency of electric receivers of various kinds, such as block tin, brass, and platinum tubes from 2 to 4 cms. long, and from 1 mm. to 1 cm. internal diameter, all of smooth bore and without any cotton wool or wire gauze filters in them; also a polished metal solid, insulated within a paraffin tunnel. This investigation, made with various quantities of air drawn through per second, has already given us some interesting and

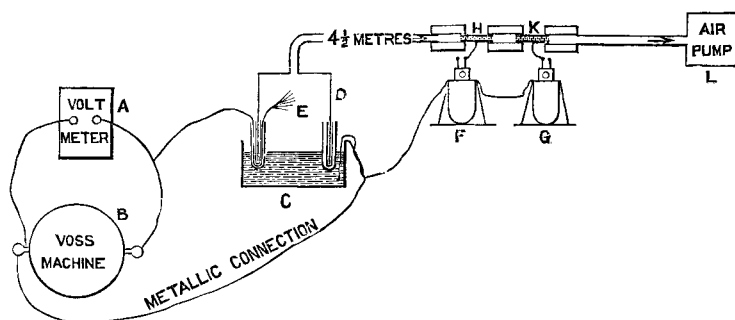


FIG. 2.

surprising results, which we hope to describe after we have learned more by farther experimenting.

§ 10. In addition to our experiments on electric filters we have made many other experiments to find other means for the dielectrification of air. It might be supposed that drawing air in bubbles through water should be very effective for this purpose, but we find that this is far from being the case. We had previously found that non-electrified air drawn in bubbles through pure water becomes negatively electrified, and through salt water positively. We now find that positively electrified air drawn through pure water, and negatively electrified air through salt water, has its electrification diminished but not annulled, if the primitive electrification is sufficiently strong. Negatively electrified air drawn in bubbles through pure water, and positively electrified air drawn through salt water, has its electrification augmented.

§ 11. To test the effects of heat we drew air through combustion tubes of German glass about 180 cms. long, and $2\frac{1}{2}$ or $1\frac{1}{2}$ cms. bore, the heat being applied externally to about 120 cms. of the length. We found that, when the temperature was raised to nearly a dull red heat, air, whether positively or negatively electrified, lost little or nothing of its electrification by being drawn through the tube. When the temperature was raised to a dull red heat, and to a bright red, high enough to soften the

¹ "On the Electrification of Air," by Lord Kelvin and Magnus Maclean.
² The gas-holder was 38 cms. high and 81 cms. in circumference. Ten strokes of the pump raised the water inside to a height of 8.7 cms., so that the volume of air drawn through the receivers in the experiments was 428 cubic centimetres per stroke of the pump. This agrees with the measured effective volume of the two cylinders of the pump.

glass, losses up to as much as four-fifths of the whole electrification were sometimes observed, but never complete diselectrification. The results, however, were very irregular. Non-electrified air never became sensibly electrified by being drawn through the hot glass tubes in our experiments, but it gained strong positive electrification when pieces of copper foil, and negative electrification when pieces of carbon, were placed in the tube, and when the temperature was sufficient to powerfully oxidise the copper or to burn away the charcoal.

§ 12. Through the kindness of Mr. E. Matthey, we have been able to experiment with a platinum tube 1 metre long and 1 millimetre bore. It was heated either by a gas flame or an electric current. When the tube was cold, and non-electrified air drawn through it, we found no signs of electrification by our receiver and electrometer. But when the tube was made red or white hot, either by gas burners applied externally or by an electric current through the metal of the tube, the previously non-electrified air drawn through it was found to be electrified strongly positive. To get complete command of the temperature we passed a measured electric current through 20 centimetres of the platinum tube. On increasing the current till the tube began to be at a scarcely visible dull red heat, we found but little electrification of the air. When the tube was a little warmer, so as to be quite visibly red hot, large electrification became manifest. Thus 60 strokes of the air-pump gave 45 scale divisions on the electrometer when the tube was dull red, and 395 scale divisions (7 volts) when it was a bright red (produced by a current of 36 amperes). With stronger currents, raising the tube to white-hot temperature, the electrification seemed to be considerably less.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—There are few changes of importance in the lists of lectures issued by the Board of Faculty of Natural Science for Academical year.

Prof. Gotch has come into permanent residence, and has appointed Dr. Gustav Mann, of Edinburgh University, to be Demonstrator in Physiology, in place of Dr. Pembrey, who has been appointed Lecturer in Physiology at the Charing Cross Hospital.

The new pathological laboratory in the Department of Regius Professor of Medicine is approaching completion, and Dr. J. Ritchie will give a course of practical Pathological Bacteriology for the Regius Professor. The present pathological laboratory is on a modest scale, and it is hoped that before long the University will be in a position to afford a building and equipment more worthy of the growing needs of the medical school at Oxford.

The examination for the Burdett-Coutts' Scholarship is to begin on October 21. There are this year two scholarships to be awarded, as none was awarded last year.

Mr. Frederic Lucien Golla, of Tonbridge School, has been elected to a Demyship in Natural Science at Magdalen College.

Four scholarships are announced for election at Wadham College on December 1, 1895, and in addition the Warden and Fellows have power to give exhibitions of £30 to £40 a year. No papers in Natural Science will be set, but in the case of one of the exhibitions preference will be given to any candidate who shall undertake to read for honours in Natural Science, and to proceed to a degree in Medicine in the University of Oxford.

CAMBRIDGE.—The election to the vacant professorship of botany will take place on Saturday, November 2, at 2.30 p.m. Candidates are to send their names and testimonials to the Vice-Chancellor, Sidney Sussex Lodge, by October 26. The electors are Dr. Vines, Mr. Sedgwick, Dr. Allbutt, Dr. D. Oliver, Dr. Phear, Mr. F. Darwin, Sir J. D. Hooker, and Prof. Foster.

The election of a head of a college to be an elector to the Sadlerian Professorship of Pure Mathematics will take place on Tuesday, October 22, at 1 p.m. The vacancy is caused by the resignation of Dr. Phear, late Master of Emmanuel. The electors are those persons whose names are on the electoral roll of the University. Dr. Ferrers, of Caius, and Dr. Taylor, of St. John's, are the present "heads" on the board of electors to the professorship.

Mr. C. T. R. Wilson, of Sidney Sussex College, has been appointed assistant-demonstrator of experimental physics in the place of Mr. Capstick, resigned.

The Clerk-Maxwell Scholarship in Physics is vacant by the

resignation of Mr. Whetham. Candidates are to apply to Prof. Thompson, at the Cavendish Laboratory, by November 1. The scholarship is worth about £180 a year, and is tenable for three years. Candidates must be members of the University who have worked for a term or more at the Cavendish Laboratory.

Among the Fellows of Trinity College elected on October 10, are Mr. C. P. Sanger, bracketed second wrangler 1893; the Hon. W. Russell, bracketed eighth wrangler 1893; and Mr. I. L. Tuckett, first class Parts I. and II. Natural Sciences Tripos, and Coutts Trotter student in physics and physiology. Mr. Sanger and Mr. Russell were also placed in the first class of Part II. of the Moral Sciences Tripos 1894.

THE London University Guide for the year 1895-96 has just been published by the University Correspondence College Press.

DR. DUNN, head master of the Plymouth Technical Schools, has been appointed principal of the Northern Polytechnic Institute, Holloway Road.

MR. HENRY LOUIS has been elected Professor of Mining at the Durham College of Science, Newcastle-upon-Tyne, by a Joint Committee nominated by the College and the Coal Trades Associations of Durham and Northumberland.

THE October *Record* of Technical and Secondary Education contains an illustrated article on the Yorkshire College, Leeds; and also a comparative summary of recent progress in technical education in various counties. This latter article continues and concludes a review of the work done by the Technical Education Committees of the English counties, commenced in the April number of the *Record*.

THE entrance scholarships at the London Hospital Medical School have been awarded as follows:—Price scholarship in science, £120, Mr. H. Bailean; Science scholarships, £60 and £35, Mr. O. Eichholz and Mr. A. B. Soltau; Price scholarship in anatomy and physiology, for university students, £60, Mr. R. C. Wall and Mr. J. H. Evans.

THE following awards have been made at St. Bartholomew's Hospital:—Scholarship of £75 in biology and physiology, to Mr. C. S. Myers; scholarship of £75 in chemistry and physics, to Mr. J. S. Williamson; scholarship of £150 in biology, chemistry, and physics, to Messrs. R. C. Bowden and R. H. Paramore; preliminary scientific exhibition of £50 in biology, chemistry, and physics, to Mr. J. C. M. Bailey.

AT St. Mary's Hospital Medical School the two university scholarships, of the value of £52 10s. each, have been awarded to Mr. R. Wade and Mr. G. S. Keeling; the first natural science scholarship, value £105, has been awarded to Mr. W. H. Willcox, and the three value £52 10s. each to Mr. H. Lovell-Keays, Mr. E. W. Holyoak, and Mr. A. F. Hayden.

AT St. George's Hospital Medical School, science entrance scholarships of £85 have been awarded to Mr. Herbert Stringfellow Pendlebury, to Mr. Henry Goodridge Deller, and to Mr. John Howell Evans.

THE following recent appointments are announced:—Prof. W. A. Setchell to the chair of botany in the University of California; Prof. H. Talbot to be associate professor of chemistry in the Massachusetts Institute of Technology; Dr. O. Jaekel, Privat-docent in geology in Berlin University, to be Extraordinary Professor; Dr. P. Lenard to the chair of physics in the Technische Hochschule at Aachen.

SCIENTIFIC SERIALS.

American Journal of Mathematics, vol. xvii. No. 4 (Baltimore, October).—On the deformation of thin elastic wires, by A. B. Basset. In the author's previous paper (vol. xvi.) on the deformation of thin elastic plates and shells, whilst commending the novelty, power and elegance of the *geometrical* investigations employed in Mr. Love's treatise on elasticity, he impugned the treatment of the *physical* portion of the subject. It is on the same ground of defective treatment that Mr. Basset considers that a further exposition on the theory of wires is needed, and this is what is furnished in the present paper. A useful table of contents precedes the text.—Investigations in the lunar theory, by Prof. E. W. Brown, is a memoir to which reference has already been made in our columns (No. 1352, p. 533).—The closing paper is by Otto Staudé, "Ueber den Sinn der Windung in den Singulären Punkten einer Raumcurve."